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My name and post-office address are as stated below:

That I am knowledgeable in the English language and in the language in which the below-identified application was filed, and that I believe the English translation of the German application No. 103 19 646.3-15, is a true and complete translation of the above-identified German application as filed.

I further declare that all statements made herein on my own knowledge are true and that all statements made on the information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both under Section 1001 of Title 18 of the *United States Code* and that such willful false statements may jeopardize the validity of the application or any registration resulting therefrom.

Date: Sept. 8, 2006

Full name of the translator: ALEXANDER ZINCHUK

Signature of the translator: Alexander Zinchuk

Post-Office Address: 340 East 74th St., Apt. 10B
New York, NY 10021

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PROPELLANT HOLDER FOR SETTING TOOL AND AN EXPLOSION-DRIVEN SETTING TOOL

The present invention relates to a propellant holder for an explosion driven setting tool for driving fastening elements such as nails, bolts, pins in a constructional component recited in the preamble of claim 1 and to an explosion driven setting tool recited in the preamble of claim 9.

Such propellant holders can be filled with a powder fuel in form of cartridges or pellets but can also be filled with a fluid or gaseous fuel, with the powder, fluid or gaseous fuel forming the propellant. These propellants serve for driving a setting mechanism in a setting tool.

With contemporary setting tools driven with a solid fuel, the cartridges or pellets are carried by a magazine strip which serves as a propellant holder and in which a plurality of pellet charges in blisters or cartridges are arranged. The magazine strips can, thus, be formed as blister or cartridge strips, respectively.

Such a propellant holder in form of a magazine strip is disclosed in U.S. Patent No. 5,811,717. There ten propellant charges are arranged on the strip, wherein at the height of the penultimate propellant charge, there is provided an indicator mark on the strip, which should indicate to the user that only one propellant charge remains on the magazine strip when the mark becomes visible in the setting tool. No other information is available to the user.

In order to insure that a large number of setting processes can be performed without replacement of cartridge, blister, or magazine strips necessary for the setting processes, there is proposed to use magazine strips having an increased length.

U.S. Patent No. 4,204,473, from which the present invention proceeds, discloses an explosion-driven setting tool and a cartridge strip therefor having a large number of propellant charges arranged in a box-shaped magazine. The cartridge or magazine strips are arranged in the box in a predetermined position.

The drawbacks of this box consists in that no information is available to the user about a number of the propellant charges that remains in the box at a predetermined time period.

A propellant holder for fluid and/or gaseous fuel is formed as a pressure container. Such a pressure container, which serves as a propellant holder, are disclosed, *e.g.*, in German Patent DE 197 46 018 C2.

U.S. Patent No. 6,336,453 discloses an aerosol container with a device having a window in which a number of remaining, in the container, aerosol portions is shown with figures, color codes, or graphic markings. The drawback here consists in that the data are not visible when the container, *e.g.*, is located in a

receptacle of a dispenser. To this end, the container must be retracted from the receptacle, which means loss of time for the user.

An object of the present invention is a propellant holder and a setting tool in which the above-mentioned drawbacks are eliminated, and a simple and comfortable recognition of a number of remaining propellant charges in a setting tool propellant holder is possible.

According to the invention, this object is achieved by features recited in the characteristic clause of claim 1 and/or claim 9, of which the following are of particular importance.

Therefore, there is arranged on a propellant holder a data storage identification unit in which the propellant supply level data are stored and are readable out. In addition to the propellant supply level data, other identification data can be stored in the data storage identification unit. These data advantageously can be easily read out electronically by the setting tool and can become easily available to the user.

On a setting tool, which is supplied with propellants by such a propellant holder, there are provided, a display for displaying propellant supply level data in a propellant holder received in a receptacle of a setting tool, a data communication interface for receiving and transmitting data, and a data processing unit connected

with both the data communication interface and the display. These features permit the user to easily ascertain at any time the propellant supply level in the propellant holder. The retraction of the propellant holder form the setting tool receptacle to ascertain the supply level is not any more necessary.

According to an advantageous embodiment of the propellant holder, there is provided on the holder a data communication interface connected with the data storage identification unit. In the embodiment of an inventive propellant holder, which can be economically produced, the data storage identification unit is formed as EEPROM or as magnetic strip.

In a further, economically produced propellant holder, the data communication interface is formed as an antenna, preferably, as a transponder antenna or as a contact element that cooperates with a mating contact element provided in the receptacle of the setting tool.

The inventive propellant holder can be formed also, *e.g.*, as a pressure can or pressure container for a gaseous and/or liquid fuel. However, the inventive propellant holder can be also formed as a box or a cassette for solid propellant charges in form of a cartridge or blister strip.

According to advantageous embodiment of the setting tool the data processing unit is connected with the ignition device or a device for shifting the

same between operational and non-operational modes. In the operation mode of the ignition device, the setting tool can perform a setting process, as in this mode, the propellant is ignited by the ignition device. According to a particular advantageous embodiment of the invention, the data processing unit actuates the ignition device for igniting the propellant when conditions are met that identification data from a data storage identification unit of the propellant holder are readable out and which are recognized by the data processing unit as authorized identification data of a propellant suitable for the setting tool, and the propellant supply level data read-out from the data storage indemnification device and communicated to the data processing unit indicate that the propellant holder is not empty. These features make the inventive setting tool particularly user-friendly.

In order to reduce the data transmission path between the data communication interfaces, which are provided, respectively, on the holder and the setting tool, to a most possible extent, the data communication interface of the setting tool is located in a region of the propellant holder receptacle.

The data communication interface of the setting tool can be formed as antenna or as a transponder antenna, or a mating contact element, or a magnetic strip reader. The data communication interfaces (and other electronic components) of the propellant holder and the setting tool are adapted to each other to form an ideal propellant holder system.

Further advantages and features of the invention follow from sub-claims, the following description, and the drawings. In the drawings, several embodiments of the invention are shown.

The drawings show:

Fig. 1 a schematic, partially cross-sectional view of a setting tool according to the present invention, with a propellant holder received in a receptacle;

Fig. 2 a plan view of the propellant holder shown in Fig. 1;

Fig. 3 a schematic, partially cross-sectional view of a setting tool according to the present invention with another embodiment of a propellant holder located in the receptacle;

Fig. 4 a plan view of the propellant holder shown in Fig. 3;

Fig. 5 a schematic, partially cross-sectional view of a setting tool according to the present invention, with a further embodiment of a propellant holder located in the setting tool receptacle;

Fig. 6 a side view of the propellant holder shown in Fig. 5;

Fig. 7 a bottom view of the propellant holder shown in Fig. 6; and

Fig. 8 a variant of the propellant holder according to Figs. 6 and 7.

A first embodiment of a propellant holder 20 according to the present invention is shown in Figs. 1 and 2. In Fig. 1, in an addition, setting tool 10 is schematically shown which will be described below. The setting tool 10 has a housing 11 and a setting mechanism 12 located in the housing 11 and including a piston guide 14, a drive piston 13 displaceable in the piston guide 14, and a cartridge receptacle 52 for receiving a propellant 23 (see Fig. 2), *e.g.*, a solid propellant charge 25 located in a cartridge or a blister. The propellant 23, which is located in the cartridge receptacle 52, can be ignited, electronically or electromechanically, by an ignition device 18. After ignition, the drive piston 13 is driven by expendable explosion gases formed in the cartridge receptacle 52 and performs a setting process, *e.g.,* driving a bolt or a nail, which is located in the bolt guide of the setting tool, into a constructional component (not shown). The setting tool 10 further includes a handle 16 on which an actuation switch 17 is located. The switch 17 is connected by an electrical conductor 35 with a data processing unit 30. The data processing unit 30 transmits, in response to actuation of the switch 17 by the setting tool user, an ignition signal to the ignition device 18 with which the data processing unit 30 is connected by an electrical conductor 36. The

setting tool 10 further includes a safety switch 19 which is connected with the data processing unit 30 by an electrical conductor 37. The safety switch 19 generates a signal, which is transmitted to the data processing unit 30, when the setting tool 10 is pressed against a constructional component into which a fastening element is to be driven with the setting tool.

The setting tool 10 further has a receptacle 15 for receiving the propellant holder 20. The propellant holder 20 is temporary secured in the receptacle 15 with a locking device 51. For securing the propellant holder 20 in the receptacle 15 in a predetermined position, there are provided guide grooves (not shown) which cooperate with guide elements 26 provided on the propellant holder 20. Retaining of the propellant holder is very important because there is provided, in the region of the receptacle 15, a data communication interface 31 (shown as being suspended) which is formed in the embodiment shown in the drawing as a magnetic strip reader 34. The magnetic strip reader 34 is connected with the data processing unit 30 by an electrical conductor 38 for exchanging data.

On the outer side of the housing 11, there is arranged an optical display 50 visible to the user and which is connected with the data processing unit 30 by an electrical conductor 39. The display 50 displays supply level data 27 indicating the supply level of the propellant holder 20 located in the receptacle 15 of the setting tool 10.

The propellant holder 20, which is shown in Figs. 1-2, has a housing 21 with an interior space 22 in which propellant 23 in form of solid propellant charges 25, which are arranged in a blister strip 29, are located. On a side wall of the housing 21, there is provided a data storage identification unit 40 in form of a magnetic strip 44. In the data storage identification unit 40, the information about the propellant 23 for providing identification data is stored. The data storage identification unit 40 also contains supply level data 27 indicating a number of solid propellant charges 25 available in the propellant holder 20.

When the propellant holder 20 is received in the receptacle 15 of the setting tool 10, the blister strip with the solid propellant charges 25 is displaced into the setting tool 10, to place a solid propellant charge 25 into the cartridge receptacle 52.

The setting tool 10 and the propellant holder 20 interact in the following way.

After the propellant holder 20 has been inserted in the receptacle 15 of the setting tool 10, the processing unit 30 reads out the identification data and the propellant supply level transmitted from the magnetic strip 44 or the data storage identification unit 40 via the data communication interface 31 or the magnetic strip reader 34. If the identification data are recognized as acceptable data, and the propellant supply level indicates that at least one solid propellant charge remains in

the propellant holder 20, the data processing unit 30, which can be formed, *e.g.*, as a microprocessor or an integrated circuit, puts the setting tool 10 in an operational mode. The propellant supply level 27 is displayed on the display 50. When a solid propellant charge 25 being consumed, the data processing unit 30 changes the propellant supply level 27 in the data storage identification unit 40 via the data communication interface 31, so that the data storage identification unit 40 always stores the actual propellant supply level 27.

Upon the last solid propellant charge 25 being consumed, the display 50 displays that no solid propellant charges remain, and the data processing unit 30 puts the setting tool 10 in its non-operational mode.

Figs. 3-4 show a further embodiment of a propellant holder 20 according to the present invention and in Fig. 3 – a corresponding setting tool 10. The propellant holder 20 shown in Figs. 3-4 differs from that shown previously in that the data storage identification unit is formed as EEPROM (electronically erasable programmable read-only memory) 45 with an integrated data communication interface 41 in the form of contact elements 43. The setting tool 10, which is shown in Fig. 3, differs from that shown in Fig. 1 in that the data communication interface 31 is formed as mating contact elements 33. For the description of the other functions reference is made to the previous description in its entirety.

Fig. 5 shows a further embodiment of the inventive setting tool 10 which is driven by a gaseous or liquid fuel 24 as a propellant. This setting tool distinguishes from those described above, substantially in that instead of a cartridge receptacle, a combustion chamber 53 is provided at a rear, with respect to a setting direction, end of the piston guide 14 and in which fuel (propellant) is ignited by the ignition unit 18. The propellant, *i.e.*, fuel is fed into the combustion chamber 53 by a metering device 28 provided downstream of the propellant holder 20. The receptacle 15 is formed for receiving a pressure container forming the propellant holder. Such a propellant holder 20 is shown in Figs. 6-8. The data communication interface 31 is formed as a transponder antenna 32 which is connected with data processing unit 30 by an electrical conductor 38.

The propellant holder 20, which is formed as a pressure container, and is shown in Figs. 6-7, has a housing 21 with an interior space 22 in which the propellant 23 in form of gaseous or liquid fuel 24 is located. At the bottom of the propellant holder 20, there is provided a transponder tag in form of a carrier element 46 for carrying the transponder antenna 42 forming the data storage identification unit 40 and the data communication interface 41. The carrier element 46 can be formed, *e.g.*, of a plastic film.

The above-described data exchange takes place between the data storage identification unit 40 of the propellant holder 20 and the data processing unit 30 of

the setting tool 10 through the data communication interfaces 31, 41. The display 50 displays the remaining amount of the propellant 23, *e.g.*, in ml, cl, or the like or displays an estimated number of remaining fuel portions and a corresponding number of possible settings. In the embodiment of a propellant holder 20 shown in Fig. 8, the above-described transponder tag or the carrier element 46 is provided on the surface of the propellant holder 20.

Regarding the functioning, the reference is made to the previous description with reference to Figs. 1-4 in its entirety.

List of Reference Numerals

10. Setting tool

11. Housing of 10

12. Setting mechanism

13. Drive piston

14. Piston guide

15. Receptacle for 20

16. Handle

17. Actuation switch

18. Ignition unit

19. Safety switch

20. Propellant holder

21. Housing for 20

22. Housing inner space

23. Propellant

24. Fuel

25. Solid propellant charges

26. Guide elements

27. Propellant supply level data

28. Metering head

29. Blister strip

30. Data processing unit

31. Data communication interface

32. Transponder antenna

33. Matching contact elements

34. Magnetic strip reader

35. Electrical conductor

36. Electrical conductor

37. Electrical conductor

38. Electrical conductor

39. Electrical conductor

40. Data storage identification unit

41. Data communication interface

42. Transponder antenna

43. Contact element

44. Magnetic strip

45. EEPROM

46. Carrier element

50. Display

51. Locking mechanism

52. Cartridge socket

53. Combustion chamber

Claims:

1. A propellant holder for an explosion-driven setting tool, comprising a housing (21) and a housing interior space (22) for receiving propellant,

characterized in that

and a data storage identification unit (40) is arranged on the propellant holder (20) in which a propellant supply level data (27) is stored and read-out.

2. A propellant holder according to Claim 1,

characterized in that

a data communication interface (41) connected with the data storage identification unit (40) is arranged on the propellant holder (20).

3. A propellant holder according to Claim 1 or 2,

characterized in that

the data storage identification unit (40) is formed as EEPROM (45).

4. A propellant holder according to Claim 1 or 2,

characterized in that

the data communication interface (41) is formed as an antenna, optionally as a transponder antenna.

5. A propellant holder according to Claim 1 or 2,

characterized in that

the data communication interface (41) is formed as a contact element (43).

6. A propellant holder according to Claim 1,

characterized in that

the data storage identification unit (40) is formed as a magnetic strip (44).

7. A propellant holder according to Claim 1,

characterized in that

the propellant holder (20) is formed as a pressure container for a gaseous and/or liquid fuel (24).

8. A propellant holder according to Claim 1,

characterized in that

in the propellant holder (20) solid propellant charges (25) are located.

9. An explosion-driven setting tool, comprising ignition means (18) for igniting propellant (23), a propellant-driven setting mechanism (12), and a receptacle (15) for receiving a holder (20),

characterized in that

on the setting tool (10), there are provided a display (50) for displaying a propellant supply level data (27) of the propellant holder (20) located in the receptacle (15), data communication interface (31) for receiving and transmitting data of the propellant holder (20) and a data processing unit (30) operationally connected with the data communication interface (31) and the display (50).

10. An explosion-driven setting tool according to Claim 9,

characterized in that

the data processing unit (30) is connected with the ignition means (18) for controlling the same.

11. An explosion-driven setting tool according to Claim 9 or 10,

characterized in that

the data processing unit (30) actuates the ignition means (18) for igniting the propellant when following conditions are met:

the data processing unit (30) receives identification data which are read-out from a data storage identification unit (40) of the propellant holder (20) received in the receptacle (15) and recognize them as authorized identification data of a propellant (23) suitable for the setting tool (10); and

propellant supply level data (27) read-out from the data storage identification means (40) and communicated to the data processing unit (30) to indicate that the propellant holder (20) is not empty.

12. An explosion-driven setting tool according to one of Claims 9 through 11, **characterized in that**

the data communication interface (31) is located in a region of the propellant holder receptacle (15).

13. An explosion-driven setting tool according to one of Claims 9 through 12, **characterized in that**

the data communication interface (31) is formed as an antenna (32).

14. An explosion-driven setting tool according to one of Claims 9 through 12, **characterized in that**

the data communication interface (31) is formed as a matching contact element (33).

15. An explosion-driven setting tool according to one of Claims 9 through 12, **characterized in that**

the data communication interface is formed as a magnetic strip reader (34).

16. An explosion-driven setting tool, according to one of Claims 9 to 12,

characterized in that

the propellant holder (20 is a propellant holder according to one of Claims 1 to 8.

17. An explosion-driven setting tool system,

characterized in that

it contains a setting tool (10) according to one of Clams 9 to 16, and a propellant holder (20) according to one of Claims 1 to 8.

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ABSTRACT OF THE DISCLOSURE

The present invention relates to a propellant holder for an explosion-driven setting tool with a housing (21) and a housing inner space (22) for receiving the propellant. For improving such a propellant holder (20), there is arranged thereon a data storage identification unit (20) in which propellant supply level data (27) are stored and are readable out.

The invention further relates to an explosion-driven setting tool including an ignition unit (18) for propellant (23), a setting mechanism (12) driven by the propellant (23), a receptacle (15) for receiving the inventive propellant holder (20). For improving such a setting tool, there are provided thereon a display (50) for displaying the propellant supply level (27) of the propellant (23) in the propellant holder, a data communication interface (31) for receiving and transmitting data of the propellant holder (20), and a data processing unit (30) connected with the display a communication interface (31).